



There is no such thing as a "national" environment. Our growing economic interdependence provides the context for global cooperation in dealing with the global ecosystem.

John Naisbitt, *Utne Reader*, November–December 1989

METAL TOXICITY

New Grounds for Drinking Coffee

New information suggests that your morning cup of coffee may be a healthy part of a nutritious breakfast. Research by an international team of scientists published in the April 2000 issue of *Human and Ecological Risk Assessment* has shown that automatic drip coffee makers can remove up to 85% of both copper and lead in tap water. Team leader Herbert E. Allen, a professor of civil and environmental engineering at the University of Delaware in Newark, speculates that coffee grounds retain heavy metals through surface chelation, a chemical reaction in which metals form complexes with organic matter. After looking at ion exchange or adsorption as possible filtering mechanisms, Allen says that due to coffee's nature—coffee grounds having uncharged or negatively charged molecules—surface chelation most likely explains the large percentage of metals removed. Because dissolved heavy metals are positively charged,

Chile in Santiago. After attending a seminar about copper in the human diet presented by Lagos, the group speculated that the amount of copper in prepared coffee would be less than the amount present in the water used to make the coffee, and they decided to conduct a study to test their idea.

In order to simulate home coffee brewing as closely as possible, the team studied three commercial coffee brands using a coffee maker with a basket-type paper-lined filter and a 12-cup-capacity glass carafe. For the first batch of each brand, the team began with the standard amount of coffee recommended by the manufacturer (one teaspoon per cup) and then adjusted that amount to 30 grams of coffee per liter of water, a strength they agreed was satisfactory. From each first batch, four samples were taken for both metal and pH analysis to establish a

batches of coffee were brewed, an increase in metal removal was observed, probably because of the increased contact time between the coffee and the water as it seeped through a thicker bed of grounds. People who prefer stronger coffee may be enjoying a greater decrease of the metals, the team says, since the stronger the coffee is brewed, the more metals may be removed. But after comparing the strongest batches and noting no additional removal of metals, they decided to continue the search for additional factors.

The team then varied the coffee grounds' consistency. They found that coarse coffee grounds removed 73% of the copper and 79% of the lead. In comparison, finely ground coffee powder removed 90% of copper and 91% of lead, suggesting that the increased surface area of the

smaller grounds enhances removal of the metals.

A moister bed of coffee also increased how much metal was adsorbed, as demonstrated by collecting samples of the coffee as it passed through the coffee bed and comparing their metal concentrations to those of the finished pot. Allen says that sorption of the metals may

also occur on interior surfaces of the coffee maker, paper filter, or glass carafe.

Although Allen says that the metal removal could actually be much higher worldwide for those who drink coffee, depending on cultural and personal tastes in coffee preparation, he says that the team's findings are important to current human exposure assessment estimates of copper and lead in tap water. Current estimates for metal exposure could be much higher than actual levels for people whose main tap water intake is through coffee.

—Lindsey A. Greene

baseline value for the amount of copper and lead in an average pot of each brand of brewed coffee. The team prepared additional batches at different volumes (but maintaining the coffee-to-water ratio) and using different concentrations of coffee to produce stronger brews. They also ran normal and metal-spiked solutions through the coffee maker both with and without a paper filter to assess sorption by the coffee maker and the filter.

The results of the team's research suggest several reasons for the lead and copper removal. When increasingly stronger

the metal ions bind strongly to the coffee, he says.

The study was conducted by Allen, graduate student Christopher Impellitteri, Michael McLaughlin of the division of soils at the Commonwealth Scientific and Industrial Research Organisation in Adelaide, Australia, and Gustavo Lagos, a scientist at the Pontificia Universidad Católica de

